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PRACTICAL RESULTS OF THE CUP AND GUTTER SYSTEM OF TURPENTINING.

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INTRODUCTION.

The cup and gutter system of collecting crude turpentine, proposed as a substitute for the box system commonly in use, was described at length in a former publication.[a] The saving that it effected was also shown in the experimental tests, the results of which were given at the same time.

Since the publication of the bulletin, experimental and comparative tests have been carried on steadily, but only the results of a year's commercial test of the new system on the turpentine farm of Messrs. Powell, Bullard & Co., at Ocilla, Ga., have been published.

This circular is issued to show the practical results of three years' working of the new system, to call attention to several improvements that have been made in equipment and methods, and to point out several faults that have developed. All the comparative tests were made on similar half crops as described in Bulletin 40. Readers who are not familiar with turpentining are referred to that publication, but it may be said in general that in this system the resin is collected in a suitable vessel, preferably of hard burned clay, being caught and conducted to this vessel by inclined metal gutters inserted in shallow cuts in the tree.

The advantages claimed for the system were two: First, that it protects the tree against the destructive action of storms and fire; second, that it increases both the quality and the quantity of the product.

RESULTS.

Since the publication of Bulletin 40 the plot of timber there described as a "first-year crop" has been worked two years more, as a "second-year crop" and as a "third-year crop," complete records being kept of the yield from the "boxed" and "cupped" halves of the crop, together with careful studies of the condition of the trees in each.

Messrs. Powell, Bullard & Co. have courteously furnished the results of the second and third years of operation. Summaries of these figures are given in Tables I, II, and III. They show that the cupped trees yielded $1,284.04 per crop, or over 30 per cent, more than the boxed trees.

[a] Bulletin 40, Bureau of Forestry, U. S. Department of Agriculture.

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TABLE I.—*Spirits of turpentine from half crops.*

Year.	Cups.			Boxes.			Excess from cupped half crop.	Net price per gallon at time of operation.	Value of cup excess.
	From dip.	From scrape.	Total.	From dip.	From scrape.	Total.			
	Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*	*Cents.*	
First	1,385.3	205.0	1,590.3	1,134.7	153.7	1,288.4	301.9	40	$120.76
Second	1,103.5	165.0	1,268.5	705.2	226.6	931.8	336.7	45	151.52
Third	781.3	136.0	917.3	536.1	190.5	726.6	190.7	45	85.82
Total	3,270.1	506.0	3,776.1	2,376.0	570.8	2,946.8	829.3	.....	358.10

TABLE II.—*Net sales of rosin from half crops.*

Year.	Cups.			Boxes.			Excess from cupped half crop.
	From dip.	From scrape.	Total.	From dip.	From scrape.	Total.	
First	$401.72	$47.72	$449.44	$328.40	$35.53	$363.93	$85.51
Second	286.88	58.24	345.12	132.42	84.08	216.50	128.62
Third	212.60	61.65	274.25	124.76	79.70	204.46	69.79
Total	901.20	167.61	1,068.81	585.58	199.31	784.89	283.92

TABLE III.—*Summary of gain from cupped half crops.*

Year.	Spirits of turpentine.	Rosin.	Total.
First	$120.76	$85.51	$206.27
Second	151.52	128.62	280.14
Third	85.82	69.79	155.61
Total	358.10	283.92	642.02

Total value of products from three years of operation.

Cupped half crop	$2,688.55
Boxed half crop	2,046.53
Gain from cupped half crop	642.02=$1,284.04 per crop.

CONDITION OF TREES.

At regular intervals during the three years of operation, careful study was made of the condition of the trees in each half of the crop. The results of these studies by years follow:

TABLE IV.—*Record of down and of dead trees.*

	Number of trees blown down.		Number of trees dead.	
	Boxed.	Cupped.	Boxed.	Cupped.
In 1 year	8	3	35	16
In 2 years	60	34	139	83
In 3 years	78	44	217	150

Of the 44 trees blown down in the cupped half of the crop during the three years of operation, only 8 fell because they were being turpentined. These 8 were small trees on which too deep incisions

had been cut by the broadax. Of the 78 trees blown down in the boxed half of the crop, the fall of 59 was due to the cutting of the boxes. The larger number of cupped trees blown down from causes other than the method of collecting the resin is due to the fact that many had doty hearts and were unfit for boxing, but just as well suited to cupping as sound trees. Many of these were snapped off above the turpentine face by a storm in the spring of 1903.

TABLE V.—*Productive surface lost from all causes.*

	Boxed trees.	Cupped trees.
	Per cent.	*Per cent.*
In 1 year	21.02	10.60
In 2 years	30.78	21.20
In 3 years	34.20	27.12

By far the greater part of this loss in both half crops was due to constantly increasing "dry face." It is evident that in the first year the box cutting was largely responsible for the wide disparity in the amount of dry face in the two half crops, but after the first year the chipping was the determining factor. In fact, the rate of increase of dry face after the first year is greater in the cupped than in the boxed trees, and is due, no doubt, to the higher average number of faces per tree in the cupped half. (See Bulletin 40, page 27.)

IMPROVEMENTS.

Since the cup and gutter system has been in use, a number of improvements in the equipment and in methods have been made.

Cups.—The quality of the cups has been materially improved. Many of those first used allowed the resin to seep through. This was due to the fact that the cups were made in molds, a method of manufacture requiring a soft, wet clay. This objection has been entirely overcome by the use of machinery and a stiff and much drier clay. The new cups allow no seepage and are just as desirable for collecting the resin as if they had been glazed at considerable cost.

Shipping the cups.—The complete success attained in shipping the cups in bulk has effected a saving to the operator, both in decreased breakage in transit and in the cost of the wooden crates formerly used.

Dipping.—At the time cups were introduced it was hoped that with experience the dippers would be able to collect as much gum per day from cups as is usual from boxes. This hope has been more than realized, for in practically all cases it has been found that the dippers are able to collect more gum per day from cups than from boxes. Difficulty was frequently experienced in getting good box dippers to undertake the dipping of cups, but after the change was once made a preference for cup dipping was uniformly noticed.

Use of the broadax for facing.—The most important advance made in the application of the cup and gutter system has been the substitution of the broadax for the club ax in making the flat faces on the trees. The difficulty in using the cornering ax recommended in Bulletin 40, on the hard timber near the Gulf coast in south Florida, led to the suggestion by Mr. R. M. Radford, of Braidentown, Fla., that the broadax be used for making the faces. The experiment was tried, and the result was faster and better work and a good surface for beginning chipping. Later, Mr. H. H. Ellarbee, of Ellarbee, Fla., suggested that the usual setting of the broadax on the handle be reversed, so that in hewing the beveled side would be next to the tree. This change greatly increased the speed of the work, as the chip could be promptly split off after the full width of the face had been obtained.

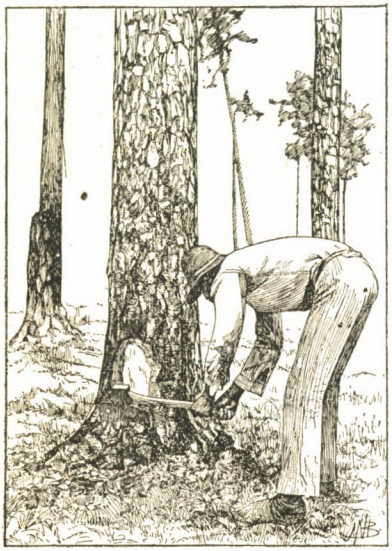

FIG. 1.—Making the first half of a face.

The next step was to have one man make both incisions for the gutters instead of employing a right-handed and a left-handed axman for making the two. At the outset the laborers usually insist that one man can not make both cuts, but a little practice gives perfect facility in cutting each with equal ease.

These changes have made it easily possible to double the speed of a squad, and many laborers have become very skillful in this use of the broadax. One laborer during the past winter prepared in one day 1,700 faces. Inspection of the work shows that it was well done in every respect.

Directions for using the broadax.—The ax should weigh from 8 to 9 pounds and have a perfectly straight edge. The handle should be straight and not longer than 30 inches. Each laborer sets his ax on the handle so that its edge is parallel to the handle and the beveled side lies next to the tree in hewing.

By almost vertical strokes of the ax a flat surface is hewn one-half the width of the "face" which is to be chipped later (fig. 1). When the ax first catches the wood the chip is prized outward slightly, thus facilitating the easy entrance of the ax in the same cut on the second stroke and also keeping the surface smooth. On the third stroke it usually is possible to partly cut and partly break off the chip, thus avoiding useless mutilation of the tree. This is done by a twist of the

ax, given just as it falls into the previous cut, the eye of the ax being thrown against the tree and the edge outward. The laborer then steps either forward or backward and hews the second side of the angular face (fig. 2), taking care to leave no rounded surface in the center where the two sides join.

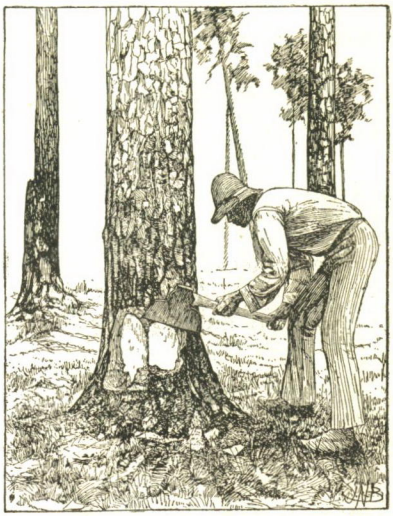

FIG. 2.—Making the second half of a face.

On these flat surfaces the incisions for the gutters are then made, one a right-handed and the other a left-handed cut (fig. 3). In making these cuts the ax is held so that the outer point of the edge is lower than the inner point, while the eye of the ax is lower than the edge. By a single blow a cut is made the full width of one side of the face, this cut being about one-quarter of an inch deep at the outer edge of the face and a little deeper at the center. The cuts should be at least one inch apart at the center of the face, to prevent choking between the two gutters by chips and "scrape," and for convenience in cleaning the gutters when the cups are dipped.

Zinc nails.—The cup and gutter system has been most favorably received by the owners of mills where the timber is sawed after it has been turpentined. The only objection they make is to the use of iron nails for hanging the cups. To meet this objection zinc nails are now manufactured for use with the cups. Experiments have shown that if such a nail is left in the tree no damage whatever is done to a saw that strikes it, because the metal is so soft.

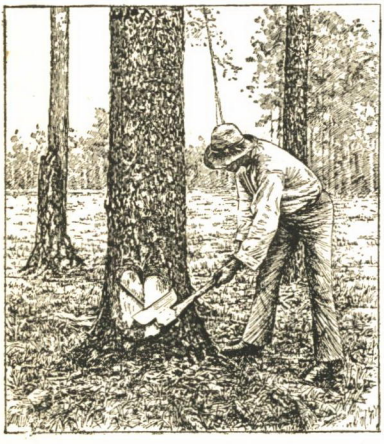

FIG. 3.—Making incisions for the gutters.

ERRORS MADE IN USING THE CUP AND GUTTER SYSTEM.

Gutters.—In making the incisions for the gutters the eye of the broadax is frequently turned down too much. The outer half of a gutter inserted in such an incision lies almost at a right angle to the trunk of the tree, and hence forms a shelf rather than a trough (fig. 5, B). From such a gutter the resin frequently runs off along the outer edge. Furthermore, such a gutter is easily forced out when the dipper is removing

the "scrape" from it, the pressure of the dip knife being almost in line with the direction of the cut. A gutter inserted carefully into a properly made incision will never fall out (fig. 5, A).

Nails.—Two mistakes are frequently made in driving the nail on which the cup hangs. First, the nail is driven horizontally. In the latter part of the season, when hardened resin collects under the head of the nail, a cup hung on it will easily drop off. The head of the nail should have a steep slant upward. A cup hung on a nail so driven fits snugly between the nail and the tree, is secure, and can not swing away from the spout of the lower gutter, though it may be easily removed by the dipper. Second, the nail is often driven into the tree above the lower end of the lower gutter. A cup hung on such a nail is never vertical, and its capacity is therefore diminished. Further, when a cup so hung fills with water or resin the increased weight tends to bring it to a vertical position, thereby pressing on the lower gutter and causing the latter to be prized out of the incision. The nail should always be driven into the tree at a point slightly lower than the lower end of the lower gutter (fig. 4).

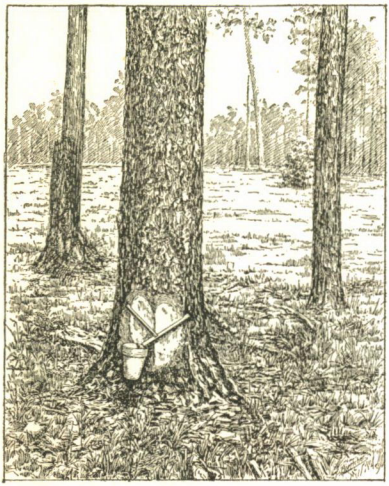

FIG. 4.—Cup and gutters properly placed.

Cups.—Experience has demonstrated that the cups will be broken if water is frozen in them. During the winter, therefore, when the cups are not in use, they should be removed from the nails and inverted at the base of the trees, so that water can not collect in them.

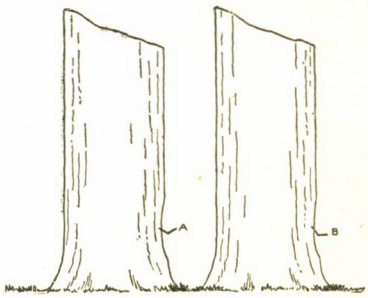

FIG. 5.—Position of gutters on the face. A, correct; B, incorrect.

FIXING LOOSENED GUTTERS.

In case a gutter is displaced during the chipping season, the accident can be easily repaired by reinserting it in the old incision and driving two nails into the tree flush with the bottom of the gutter—one nail near the center of the face and the other near the upper end of the gutter. Supported by these two nails a gutter will stand the scraping of the dip knife without slipping. The gutter and both nails can readily be drawn from the tree at the end of the season.

APPRECIATION OF THE NEW SYSTEM.

The rapid introduction of the cup and gutter system by turpentine operators proves beyond a doubt that the experimental stage has been passed. No stronger confirmation of the value of the results obtained at Ocilla, Ga., could be given than the fact that by far the greater portion of the cups placed during the past winter were on farms where the cup had been tested on a small scale during the preceding season. Not all operators are yet convinced; there are still doubters and scoffers, but their number is rapidly diminishing.

In the hands of a few the system has been abused. The fact that under it the trees are not weakened and made subject to overthrow by windstorms, as boxed trees are, has induced some operators to largely increase the number of cups per tree as compared with the average of boxes. The returns from such trees prove that there is a distinct limit to the sap surface which can be removed without weakening the vitality of the tree and lessening the flow of resin. The practice of overcupping results, therefore, in a financial loss.

In addition to the increased returns from the use of cups, the naval-stores industry has been benefited in two other lines by the development of the cup system. In many cases timber owners have made decided concessions in their leases to operators, on condition that the cups be used and no boxes cut. In other instances large tracts of timber have been brought under turpentine operation by the cup system, though their owners have persistently refused to lease them for box cutting.

The rapid rise in the value of turpentine timber within the past few years has contributed largely to its more conservative treatment. A thing of little value in the past, it has received only a small amount of care. Its rapid enhancement in value, and the strong probability of a still further increase, gives the turpentine operator every reason to treat his timber carefully. Formerly it was an easy matter for an operator to work hastily through a place, then move a short distance and develop a new place on timber just as inexpensive as that on which he had been working. But now the operator knows that when his present location is exhausted he is certain to experience difficulty in finding a new location, and equally certain that a largely increased price must be paid for it. This natural operation of the law of supply and demand is rapidly bringing serious and earnest thought to the question of how best to preserve the present holdings. The cup and gutter system with its great economies is doing much to solve the problem.

Approved:

W. M. HAYS, *Acting Secretary.*

WASHINGTON, *May 27, 1905.*

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